Relay-assisted D2D underlay cellular network analysis using stochastic geometry: overview and future directions

ABSTRACT

Device-to-Device (D2D) communication is one of the enabling technologies for meeting the capacity requirements of the fifth-generation wireless systems (5G). It has diverse applications in traffic offloading, disaster management and content sharing, to mention a few. The network coverage and capacity further improve when relays are introduced to D2D communication. However, the interference becomes more severe since these devices also share resources with the traditional cellular users in the underlay. To take the benefits and avert the drawbacks of this spectrum sharing scenario, analytical tools capable of revealing the mathematical relationships among pertinent network design parameters are needed. This brings stochastic geometry (SG) into the picture. With SG-based analyses, designers can model concepts to understand, provide insights, and address the problems of spectrum sharing in relay-assisted D2D communication. Some of the key metrics of particular interest to network designers are the transmission capacity and spectral efficiency of D2D communication, as they reveal the performance gains and quantify the level of interference within the network. These enable them to properly correlate relevant cause-and-effect relationships before wealth and time are invested in network implementation. Despite the studies on the analysis of relay-assisted D2D underlay cellular networks using SG in recent years, there is no available survey material where researchers can find models, assumptions, key results and derived lessons to further comprehend this area and open up new research lines. This motivates the presentation of this paper which in addition to the aforementioned, gives elaborate discussions on promising areas for future research with respect to the recent advancements in D2D communication and SG research.

Keyword: D2D, Energy efficiency; Relay; Spectral efficiency; Stochastic geometry; Survey; Transmission capacity